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07/06/2009 11:27 AM

To Kevin Cardwell <kcardwell@fs.fed.us>, Bonita Lavelle/R8/USEPA/US@EPA
cc
bcc
Subject Fw: Control burn methodology-Rx Burn

History: This message has been replied to and forwarded.

we are planning july 21-22 for the Rx burn and monitoring - - see operating plan below

Malcolm R Edwards
Libby Ranger District
406 293 7773 (work)
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----- Forwarded by Malcolm Edwards/R1/USDAFS on 07/06/2009 11:23 AM -----

"Hart, Julie" <JHart@mtech.edu>

07/06/2009 11:05 AM

To Malcolm Edwards <medwards01@fs.fed.us>
cc
Subject Control burn methods

Greetings Malcolm,

Terry and I are running a bit late calling you this morning. If you are still in your office, please give Terry a call (406-496-4445) (he has a speaker phone in his office). If you get this message later, we will plan on calling early (8:00 AM) tomorrow morning. I have attached the control burn methods that we initially drafted in January. There are a few specifics under methods (page 3) that we need discuss more such as the distance of the fire line from the controlled burn, etc. We can chat more about this during the call. Take care - Julie

An evaluation of potential amphibole exposure associated with a small-scale control burn operation in the Kootenai National Forest near a former vermiculite mine.

A. Background and Significance

A mine near Libby, MT supplied nearly 80% of the world's vermiculite from 1963-1990. Unfortunately, vermiculite from the Libby mine is contaminated with a toxic form of naturally-occurring fibrous and non-asbestiform amphibole (Pardee and Larsen, 1929). Exposure to amphibole asbestos has resulted in high incidences of asbestos related disease in the former mine and mill workers, as well as the general Libby population (McDonald et al., 1986; Amandus and Wheeler, 1987; Amandus et al., 1987; Dearwent et al., 2000).

It was recently discovered that tree bark and duff collected within the forested area near the former mine contain varying levels of amphibole contamination (Ward et al., 2006) (EPA, 2008). Researchers hypothesize that amphibole fibers were dispersed from the mining operation and were impacted or intercepted on nearby trees. Activity simulation studies have revealed that amphibole fibers are released from tree reservoirs resulting in a potential for human exposure (Hart et al., 2007, Hart et al., in press).

Much of the land surrounding the former vermiculite mine is owned by the United States Department of Agriculture Forest Service (USDA)(FS) and private logging companies. Kootenai District FS personnel have established a FS restricted zone (FSRZ) boundary around the former mine. The primary objective of this boundary is to define the type of response that will be employed during a forest fire event. Fires within the yellow boundary are fought by the air only, while fires outside of the boundary may be fought on the ground. This boundary was established based on the tree bark and duff sampling results described above. Research evaluating the potential for amphibole exposure associated with forest fire events in areas contaminated with amphibole asbestos has not been conducted.

The objective of this research is to evaluate the potential for occupational and ambient amphibole exposure associated with a small-scale control burn operation in the Kootenai Forest near the former vermiculite mine.

B. Specific Aims

This proposal is comprised of two Specific Aims.

Specific Aim 1: Determine if there is a potential for airborne amphibole exposure to FS employees performing a small-scale control burn in the Kootenai National Forest near the former vermiculite mine. Through the analysis of personal breathing zone (PBZ) samples collected during fire line construction and control burn activities, determine the potential for occupational inhalation exposure. Through the analysis of ambient air samples collected during the control burn activities, determine the potential for ambient inhalation exposure.

Specific Aim 2: Determine if there is a potential for clothing and equipment contamination associated with a small-scale control burn in the Kootenai National Forest near the former vermiculite mine. Through the analysis of Tyvek® clothing and equipment (chainsaw bar, pumper truck, Pulaski tool) surface wipe samples collected immediately after the fire line construction and control burn activities, determine the potential for clothing and equipment contamination.

C. Preliminary Studies

Trees as Reservoirs for Amphibole Fibers

Tree bark and core samples were collected around the former W. R. Grace vermiculite mine and former processing structures in 2004 in support of a proposed firewood harvesting/commercial logging exposure study (Ward, et al., 2006). Samples were collected from three separate, heavily forested locations to simulate a probable amphibole fiber concentration gradient from the mine. Based on the results of the initial samples, a follow-up sampling program was conducted both in the town of Libby and directly outside the city limits.

Analyses to date have yielded substantial amphibole fiber concentrations ranging from 41 million to 530 million fibers per gram of bark, while a bark sample collected approximately seven miles west of town along the railroad line had concentrations of 19 million fibers per gram. A conversion of these mass-based concentrations to areal concentrations (to reflect surface area contamination) revealed concentrations in excess of 100 million amphibole fibers per cm2.

Evaluation of Asbestos Exposures During Firewood Harvesting Simulations

A pilot study was conducted in order to assess potential exposure to asbestos while harvesting firewood from amphibole-contaminated trees near Libby (Hart et al., 2007). Three firewood-harvesting simulations were conducted in the summer and fall of 2006 in the Kootenai Forest inside the EPA restricted zone surrounding the former vermiculite mine. Another simulation was conducted near Missoula, Montana which served as the control. The work practices following each simulation were consistent throughout each trial. Personal breathing zone (PBZ) asbestos concentrations were measured by phase contrast microscopy (PCM) and transmission electron microscopy (TEM). Surface wipe samples of personal protective clothing were measured by TEM.

The mean (n=12) PBZ PCM sample time weighted average concentration was 0.29 fibers per milliliter (ml), standard deviation (SD = 0.54). A substantial portion (> five fibers per sample) of non-asbestos fibers (cellulose) was reported on all PBZ samples (excluding field blanks) when analyzed by TEM. The mean (n=12) PBZ TEM sample time weighted average concentration for fibers < 5 microns μm long was 0.15 fibers per ml (SD = 0.21) and the mean (n=12) PBZ TEM concentration for fibers > 5 μm long was 0.07 fibers per (ml); (SD = 0.08). Substantial amphibole fiber concentrations were revealed on Tyvek® clothing wipe samples. The mean concentration (n = 12) was 29,823 fibers per square centimeter (cm2) (SD = 37,548), with ninety-one percent (27,192 fibers per cm2) comprised of fibers < 5 μm long. There were no significant differences in PBZ and wipe sample concentrations among the tasks performed by four investigators.

Each of these three simulations were consistent in demonstrating that amphibole fibers were released from tree reservoirs during firewood-harvesting activities in asbestos-contaminated areas, and that the potential for exposure exists during such activities.

Evaluation of Amphibole Exposures associated with Simulated FS activities in the Kootenai National Forest

A pilot study was conducted in order to assess potential exposure to Libby amphibole associated with FS employee activities in the Kootenai National Forest near a former vermiculite mine (Hart et al., in press). Tree bark samples were collected as preliminary data within a three mile radius of the mine to determine if amphibole contamination was present in areas frequented by FS personnel. Tree bark samples were also collected near Missoula, Montana to serve as a control. Bark samples analyzed by transmission electron microscopy (TEM) revealed amphibole fiber contamination ranging from 37 thousand to 15 million structures per square centimeter (s/cm2) of bark surface area. Amphibole fibers were not detected in the control sample.

Two simulation trials each were performed of the following FS activities: walking through forested areas, tree measurement, and fireline construction activities. In addition, one trail maintenance activity and three roadway driving activity simulations were performed. Personal breathing zone (PBZ) asbestos concentrations were measured by phase contrast microscopy (PCM) and TEM. Surface wipe samples of personal protective clothing and vehicle surfaces were measured by TEM.

The mean (n = 24) PBZ PCM sample time weighted average concentration across all tasks was 0.15 fibers per milliliter (ml), standard deviation (SD = 0.16). The fireline construction activity was associated with the highest mean PBZ PCM sample weighted average concentration of 0.31 fibers/ml (SD = 0.11). Twenty-five percent of the PBZ samples revealed concentrations greater than the analytical sensitivity (AS) when analyzed by AHERA TEM. These samples were collected during the fire line construction and tree measurement simulation activities. Fifty-five percent of post activity wipe samples revealed concentrations greater than the AS with mean concentrations for samples greater than the AS (n = 10) of 941 s/cm2 (SD = 899). While the highest wipe sample concentrations were associated with the fireline construction activity, amphiboles were detected on wipe samples collected from all of the activities evaluated.

These simulations demonstrate that a potential for amphibole exposure exists with common tasks performed by FS personnel in the Kootenai National Forest. Based on this data, the activity performed may be a factor in evaluating potential inhalation exposures. However, all of the activities evaluated revealed the potential for clothing contamination.

This research was funded as a small project/pilot study in order to assess potential FS exposure to Libby amphibole. A limited number of samples were collected within a relatively small geographical area. Further research is necessary to assess FS exposure potentials with the activities evaluated in this study throughout a range of meteorological conditions (i.e., different seasons) as well as other activities (i.e., fire fighting), in expanded radii from the former vermiculite mine. In addition, vehicle cabs, offices and equipment storage and maintenance facilities should be evaluated for potential amphibole contamination.

D. Methodology

Specific Aim 1 Methodology

The Kootenai National Forest Ranger Station is located approximately 9 miles Northeast of Libby, Montana off of U.S. Highway 37. There are approximately fifteen FS employees working through this station. Of these, five perform primarily administrative functions and ten work in the field. The tasks performed by the field workers include driving in motor vehicles on FS roadways, walking through forested areas, performing tree measurement activities, constructing firelines, and performing trail maintenance. In addition, field workers perform fire fighting activities if necessary. Due to the tree bark and duff contamination revealed from USEPA sampling activities (USEPA, 2008), ground fire fighting activities are not performed within an approximate four mine radius from the former vermiculite mine.

A small-scale (10 feet by 10 feet) control burn will be conducted on FS land approximately one mine east or northeast of the former vermiculite mine. The control burn will be conducted by a Montana Tech/University of Montana research team and a Kootenai National Forest fire boss. The research team and fire boss will first construct a ___ feet wide fire line ___ feet from the perimeter of the planned burn. PBZ samples will be collected for each researcher during this activity. A fire will then be ignited by the fire boss and observed by the research team. Anticipated fuel for the control burn will include duff, timber litter, and logs. Additional fuel load, nearby duff and logs, will be added as necessary by the research team in order to achieve a 30 – 45 minute burn duration. PBZ samples will be collected for each researcher during this activity. In addition, five stationary ambient samples and one mobile ambient sample will be collected. The stationary samples will be positioned four to five feet from ground level in the fire line perimeter, north, south, east, and west of the burn, as well as directly above the burn, approximately __ feet from ground level. A mobile ambient sample will be positioned in the fire line perimeter and will be moved by the research team into the smoke plume as the plume movement changes with wind direction.

SKC Aircheck® personal sampling pumps will be used to collect PBZ samples for each researcher. The pumps will be calibrated prior to and after sampling at 3 liters per minute (LPM). SKC Leland Legacy sampling pumps will be used to collect the ambient air samples. The pumps will be calibrated prior to and after sampling at 9 LPM. The PBZ and ambient sampling media will consist of 25 millimeter (mm), 0.8 micron (µm) cellulose ester membrane filters in non-conductive cassettes. The cassettes will be capped immediately after the sampling period and sent to the contracted lab for asbestos analysis. It is anticipated that approximately 12 PBZ and 12 ambient air samples will be collected.

Specific Aim 2 Methodology

Pre-moistened SKC ghost wipes will be used to collect clothing and equipment surface wipe samples. A disposable 10 x 10 centimeter (cm) template will be employed to ensure consistency in the size of the area wiped. Three wipe samples will be collected for each researcher after the fire line construction and control burn activity. Wipe samples will be collected from the chest, forearm, and shin. These three wipe samples will be analyzed as one composite sample. Surface wipe samples will be collected on equipment after the fire line construction and control burn activity. It is anticipated that approximately 25 composite wipe samples will be collected.

Air and Wipe Sample Analysis

PBZ and ambient air samples will be analyzed for asbestos per National Institute for Occupational Safety and Health's Manual of Analytical Method (NMAM) 7400, Asbestos and Other Fibers by PCM (NIOSH, 1994) and for asbestos per EPA's Asbestos Hazard Emergency Response Act 's (AHERA), Airborne Asbestos by TEM, EPA Enhanced Protocol

(Level III) (EPA, 1987). All air samples will be analyzed by an independent, National Voluntary Laboratory Accreditation Program (NVLAP) certified and American Industrial Hygiene Association (AIHA) accredited laboratory. PBZ and ambient air samples submitted will include ten percent field blanks.

Wipe samples will be analyzed for asbestos per ASTM's D 6480-05 Method, TEM Asbestos Analysis (ASTM, 2006) by an independent, NVLAP certified and AIHA accredited laboratory. In addition to the post task wipes collected, pre task wipes, inner layer Tyvek® wipes and ten percent field blanks will be analyzed.

Data Analysis

PBZ air sample results will be compared to published Occupational Exposure Levels (OELs). These OELs include the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) and the Occupational Safety and Health Administrations (OSHAs) Permissible Exposure Limits (PELs) for asbestos. The ACGIH TLV for all forms of asbestos fibers is 0.1 fiber per cubic centimeter of air (f/cc). The OSHA PEL for all forms of asbestos is 0.1 f/cc and 1.0 f/cc excursion limit. Both the TLV and PEL of 0.1 f/cc are 8 hour time-weighted average (TWA) concentrations. The PEL may be exceeded for brief periods, but the sum of the exposure levels averaged over 8 hours is not to exceed the PEL. The OSHA excursion limit considers a time-weighted sampling period of 30 minutes. This allows exposure up to 1.0 f/cc for up to a 30 minute period as long as the 8-hour time weighted average concentration of 0.1 f/cc is not exceeded.

There are no applicable occupational exposure limits for asbestos wipe samples. The purpose of the wipe sampling is to evaluate the potential for clothing and equipment contamination. Amphibole concentrations potentially detected from clothing and equipment samples will be compared for each task performed. Clothing and equipment contamination may serve as a secondary source of exposure to those that work in areas with amphibole contamination. In addition, family members, etc., not occupationally exposed to asbestos, may be exposed while laundering contaminated clothing.

Hazard Precautions

A job hazard analysis conducted by the research team has identified potential hazards that may be encountered while conducting this research. These hazards include potential asbestos exposure, noise exposure, heat stress, risk of being struck by falling trees or debris, risk of being hit by flying objects, risk of thermal burns, and wild animal encounters. In order to minimize these hazards, researchers will be accompanied by a FS fire boss at all times. The team will carry a Kootenai National Forest emergency radio. Researchers and the fire boss will be suited in level C personal personal protective equipment (PPE). This PPE will consist of hooded Tyvek® coveralls, neoprene gloves, Tyvek® booties, a half mask air purifying respirator with P100 filters, work boots, and hard hat. Researchers will carry 2 20 pound dry chemical fire extinguishers. Adequate work breaks will be taken and the investigators will be encouraged to drink plenty of liquids. All investigators will have obtained medical clearance to wear negative pressure respiratory protection and will have passed quantitative fit tests.

E. References

Agency for Toxic Substances and Disease Registry (ATSDR). (2006) ToxFAQ for Asbestos, [online] Available from URL: http://www.atsdr.cdc.gov/tfacts61.html.

Amandus HE, Wheeler PE, Jankovic J, Tucker J. 1987. The morbidity and mortality of vermilite miners and millers exposed to tremolite-actinolite: Part I. Exposure estimates. Am J of Ind Med; 11: 1-14.

Amandus HE, Wheeler R. 1987. The morbidity and mortality of vermilite miners and millers exposed to tremolite-actinolite: Part II. Mortality. Am J of Ind Med; 1: 15-26.

American Society for Testing and Materials Standards (ANSI). (2006) D6480-05, Standard Test Method for Wipe Sampling of Surfaces, Indirect Preparation, and Analysis for Asbestos Structure Number Concentrations by Transmission Electron Microscopy. ASTM Internaltional [online] Available from: URL: http://www.astm.org/cgi-

bin/SoftCart.exe/DATABASE.CART/REDLINE_PAGES/D6480.htm?L+mystore+ehme8257+1175904007.

Dearwent S, Imtiaz R, Metcalf S, Lewin M. 2000. Health consultation—Mortality from asbestosis in Libby, Montana: Agency for Toxic Substances and Disease Registry; [online] Available from: URL: http://www.atsdr.cdc.gov/HAC/pha/libby/lib_toc.html.

Hart, J.F., Ward T.J., Spear T.M., Crispen, K., Zolnikov, T.R. "Evaluation of asbestos exposures during firewood harvesting simulations in Libby, Montana – Preliminary Data," In Press, Annals of Occupational Hygiene.

McDonald JC, McDonald AD, Armstrong B, Sebastien P. 1986. Cohort study of mortality of vermiculite miners exposed to tremolite. Brit J Ind Med; 43: 436-444.

Meeker GP, Bern AM, Brownfield IK, Lowers HA, Sutley ST, Hoefen TM, Vance JS. (2003) The Composition and Morphology of Amphiboles form the Rainy Creek Complex , Near Libby, Montana. American Minerologist; 88:1955-1969.

National Institute for Occupational Safety and Health (NIOSH): (1994) Asbestos and Other Fibers by PCM – Method 7400. NIOSH Manual of Analytical Methods, 4th ed.

Pardee JT, Larsen ES. (1929) Deposits of vermiculite and other minerals in the Rainy Creek District, near Libby, Montana: USGS Bulletin; 805: 17-28.

United States Environmental Protection Agency. (1987) 40 CFR Part 763. Fed. Reg., 52(210), 41826-41905.

United States Environmental Protection Agency (EPA) 2008. Asbestos Levels in Tree Bark. Project number 0100-008-900.

Ward T, Spear T, Hart J, Noonan C, Holian A, Getman M, Webber J. (2006) Trees as reservoirs for amphibole fibers in Libby, Montana, Science of the Total Environment; 367(Aug. 15):460-465.